DEVICE FOR DETECTING ACTIVATION MOVEMENT FOR LASER GYROSCOPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to mechanically actuated laser gyrometers used in certain inertial units to measure rotational speeds.

2. Discussion of Background

The principle of a single-axis laser gyrometer is based on the use of two monochromatic light beams that are propagated in opposite directions in a plane along one and the same closed-loop pathway. When the plane of the pathway of the two counter-propagating monochromatic light beams is animated by a motion that is rotational with respect to its axis, the effective lengths of the pathways travelled by the two beams change, giving rise to a difference in frequency between the two beams since the oscillation frequency of a laser is dependent on the length of the path travelled by its beam. This difference in frequency, which can be measured by obtaining the interference of the two beams in a photodetector, then gives a measurement of the speed of rotation of the plane of the pathway of the two light beams about its axis which is the sensitive axis of the gyrometer. However, when the difference in pathways between the two beams is small, the two light beams tend to get coupled and oscillate at one and the same frequency, so much so that it is difficult to measure low rotational speeds. To overcome this lack of sensitivity of single-axis laser gyrometers to low rotational speeds, there are known ways of giving them a mechanical vibrational motion of oscillation about their sensitive axis in order to increase their apparent rotational speed and enable the measurement of the low rotational speeds. This mechanical oscillatory motion is called actuation. The shift that occurs in the rotation measurement given by the gyrometer is subsequently eliminated by appropriate processing when the gyrometer signal is exploited.

The mechanical vibrational actuating motion is generally obtained by mounting a single-axis laser gyrometer in a hollow cylindrical jacket using two fastening rings that are coaxial with its sensitive axis and have a certain degree of flexibility in rotational torsion. These fastening rings are fixed by their hub or inner periphery to the body of the gyrometer and by their rim or outer periphery to the hollow cylindrical jacket which is itself mounted in a casing by means of several elastic shock absorbers evenly distributed on its edge. One of the fastening rings is fitted out with a piezoelectric oscillatory motor used to generate and sustain the actuating oscillations.

Triaxial laser gyrometers are constituted by a rigid assembly of three single-axis laser gyrometers having their sensitive axes oriented along the three axes of a trirectangular trihedron and, as the case may be, by common elements. To remedy their lack of sensitivity to low rotational speeds, they are actuated by a single oscillatory vibrational motion about an axis that is oriented differently from their sensitive axes in a direction such that this motion has same-amplitude components of oscillation about the three sensitive axes of the three single-axis laser gyrometers. To obtain this actuating motion, the three single-axis laser gyrometers constituting a triaxial laser gyrometer unit are mounted, like a single-axis laser gyrometer, inside a hollow cylindrical jacket by means of two fastening rings that are coaxial with the actuation axis of the gyrometer unit. As in the above case of a single-axis gyrometer, these rings have a certain degree of flexibility in rotational torsion. They are fixed by their hub or inner periphery to the triaxial laser gyrometer unit and by their rim or outer periphery to the hollow cylindrical jacket which in its turn is fixed in a casing by means of several elastic shock absorbers evenly distributed on its rim. One of the fastening rings is provided with a piezoelectric oscillatory motor used to generate and sustain the actuating oscillations.

When a single-axis or triaxial laser gyrometer is subjected to mechanical actuating oscillations, it is necessary to determine the proportional share of these actuating oscillations in the measurement or measurements of rotational speeds delivered so as to eliminate this share and keep only that part which corresponds to the measurements of the true rotational speeds of rotation of the carrier of the gyrometer. To achieve this and also to adjust the excitation of the piezoelectric motor, it is useful to know the effective amplitude of the actuating vibrations. This is done in a known way by fitting out the motor-driven ring with an actuating motion detector.

The fastening rings of a mechanically actuated gyrometer usually have the form of a spoked wheel with a hub held in the center of a rim by flexible radial strips, positioned in transversal planes and evenly distributed around the hub, that act as springs.

The piezoelectric motor consists of piezoelectric ceramic plates provided on their sides with excitation electrodes and bonded to several radial strips that fixedly join the hub to the rim of the motor-driven, fastening ring. These piezoelectric plates, when excited appropriately by a voltage, give rise to a bimetallic effect on the radial strips. This bimetallic effect, when it is repetitive, causes rotational oscillations between the hub and the rim of the motor-driven fastening ring.

The actuating motion detector commonly used consists of a torsion detector consisting of a single piezoelectric plate cross-polarized polarized by a remanent magnetic field, coated on its sides with two electrodes and bonded to one of the radial strips of the motor-driven fastening ring that has no driving piezoelectric plates. The piezoelectric plate of the torsion detector is not excited electrically and, between its electrodes, it gives electrical charges like a capacitor. The number and polarization of these electrical charges are a function of the deformations undergone by the radial strip that carries the plate. The plate has the drawback of being sensitive not only to mechanical actuating vibrations but also to parasitic mechanical vibrations originating in external mechanical disturbances. Indeed, an impact or vibrations applied to the casing of the gyrometer dictate an acceleration on the suspended part of the gyrometer. This acceleration deforms the flexible strips of the fastening ring. These deformations are detected by the piezoelectric ceramic plate of the torsion detector in the same way as those due to the actuating vibrations. They are the cause of a noise in the output signal of the torsion detector which gets added to the useful component due to the actuating vibrations and is difficult to eliminate by signal processing because it occupies a very wide frequency range that overlaps the frequency range of the actuating vibrations.

SUMMARY OF THE INVENTION

It is an aim of the present invention to provide an actuating motion detector for gyrolasers that has lower sensitivity to external mechanical disturbances.

An object of the invention is an actuating motion detection device for mechanically actuated gyrolasers fitted out with at least one fastening ring that is coaxial with its